

The Air Force **PILOT** **SHORTAGE** A Crisis for Operational Units?

DISTRIBUTION STATEMENT A

Approved for Public Release
Distribution Unlimited

20000628 091

William W. Taylor • S. Craig Moore • C. Robert Roll, Jr.

Project AIR FORCE
RAND

The research reported here was sponsored by the United States Air Force under Contract F49642-96-C-0001. Further information may be obtained from the Strategic Planning Division, Directorate of Plans, Hq USAF.

ISBN: 0-8330-2857-X

RAND is a nonprofit institution that helps improve policy and decisionmaking through research and analysis. RAND® is a registered trademark. RAND's publications do not necessarily reflect the opinions or policies of its research sponsors.

© Copyright 2000 RAND

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from RAND.

Published 2000 by RAND

1700 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138

1200 South Hayes Street, Arlington, VA 22202-5050

RAND URL: <http://www.rand.org/>

To order RAND documents or to obtain additional information,
contact Distribution Services: Telephone: (310) 451-7002;

Fax: (310) 451-6915; Internet: order@rand.org

PREFACE

The United States Air Force is facing the largest peacetime pilot shortage in its history. This report examines the origin and nature of the shortage along with retention issues, and shows that the real problem is experience levels in operational units. It includes insight gained from RAND's participation in the Rated Management Task Force (RMTF) convened by the Air Force Chief of Staff to define and study these issues.

The study was undertaken in the Manpower, Personnel, and Training Program and the Resource Management Program of RAND's Project AIR FORCE. It originated in a project on readiness but later was tailored to address issues raised within the Air Force. The study team expanded its endeavor to incorporate direct assistance work on pilot retention and rated management for the DCS/Plans and Operations and the DCS/Personnel, Headquarters USAF. This report also documents response to specific questions raised by the Vice Chief of Staff of the Air Force regarding the potential for Total Force alternatives to alleviate active unit experience problems that the analysis identified. The study team communicated key results to appropriate Air Force leaders before the Four-Star Rated Summit made its critical policy decisions on pilot production and absorption for Fiscal Year 2000 and beyond.

The report should be of interest to those concerned with rated management and pilot retention problems, operational unit readiness, and Total Force manning and integration initiatives.

PROJECT AIR FORCE

Project AIR FORCE, a division of RAND, is the Air Force federally funded research and development center (FFRDC) for studies and analyses. It provides the Air Force with independent analyses of policy alternatives affecting the development, employment, combat readiness, and support of current and future aerospace forces. Research is performed in four programs: Aerospace Force Development; Manpower, Personnel, and Training; Resource Management; and Strategy and Doctrine.

CONTENTS

Preface	iii
Figures	vii
Table	ix
Summary	xi
Acknowledgments	xvii
Abbreviations and Acronyms	xix
Chapter One	
THE PILOT SHORTAGE	1
The Origin of the Shortage	1
The Nature of the Shortage	4
The Real Crisis Is in Fighters	4
The Shortage Consists Solely of <i>Experienced</i> Pilots	4
Retention Issues	5
Major Airline Pilot Demographics	6
Major Airline Pilot Demand	7
Chapter Two	
EXPERIENCE LEVELS IN OPERATIONAL UNITS: THE	
REAL ISSUE	11
The Analytic Framework	11
Experience and Inexperience	12
The Problem with Decreasing Experience	14
Preliminary Results	15
Aircraft Utilization (UTE) Rate Constraints (Why the	
Required Sortie Increase Cannot Be Flown)	17

Inexperience Feeds on Itself in Fighter Units	18
The Aging Rate for New Pilots	18
The Aging Rate Deficit	20
The Slippery Slope	22
Chapter Three	
CONTROLLING EXPERIENCE LEVELS	27
Options Are Limited	27
Absorb Fewer Pilots	27
Reduced Pilot Production Is Not a Viable Long-Term Solution	28
Total Force Alternatives	29
Follow-on to PROJECT SEASON	29
Associate Programs	33
Guard and Reserve Manning Issues	35
Chapter Four	
CONCLUSIONS	39
Appendix	
A. A BRIEF OVERVIEW OF RAND'S OPERATIONAL UNIT TRAINING MODEL	43
B. DERIVATION OF FORMULAS USED IN LOW-EXPERIENCE EXAMPLES	47
Bibliography	49

FIGURES

1.1. Pilot Inventory Is Dropping Sharply and Remains Below Requirements	2
1.2. Airline Demand for Military Pilots Is Likely to Remain Strong	8
2.1. Flow of Fighter Pilots	13
2.2. Sortie Requirement Increases Generated by Reduced Experience in Fighter Squadrons	17
2.3. Inexperienced Wingmen Lose Sorties Proportionately as Unit Experience Drops	19
2.4. The Aging Rate Drops Rapidly as the Experience Mix Falls	21
2.5. If the Deficit Is Ignored, Experience Appears to Approach a Steady-State Value	22
2.6. In Reality, the Aging Rate Deficit Yields a "Slippery Slope"	23
3.1. Experience Levels Improve as Fewer Fighter Pilots Are Absorbed in Operational Units	28
3.2. If Active Pilots Can "Age" in Guard or Reserve Units, Experience Levels Will Be Higher in Active Fighter Units	30
3.3. Training 40 Pilots Per Year in Guard or Reserve Units Essentially Eliminates the Effect of the Aging Rate Deficit	31
4.1. If Units Fly at the Programmed Rate, They Can Maintain Experience at Acceptable Levels	41
4.2. If Units Fly Below the Programmed Rate, Aging Rate Problems Restore the "Slippery Slope"	42
A.1. The Model Starts with Fundamental User Inputs	44

A.2. The Model Next Matches Required Skills to Available Training Activities	45
A.3. Finally, the Model Identifies Essential Training and Tallies the Resources Required	46

TABLE

2.1. Training Needs Depend on Pilot Qualifications and Unit Experience Level	16
---	----

SUMMARY

The Air Force has been losing unprecedented numbers of experienced pilots, who are leaving at the end of their initial active duty service commitment (ADSC) and at the end of the initial bonus-payback period. These losses apparently occur because (1) employment opportunities are excellent in the private sector and (2) continued high tempos for contingency support operations are degrading their quality of life. In the face of high losses and difficulty in training new pilots and absorbing them into operational units, the Air Force faces a growing shortfall. As widely reported, the Air Force reached a shortfall of 1000 pilots in FY1999 and projects a shortfall twice that size by FY2002, which will stay that large (or larger) through FY2007. Throughout the period, about half of the shortfall occurs in fighters.

Moreover, because the Air Force hired and trained insufficient numbers of new pilots during its major force drawdown in the early 1990s, the shortfall is most critical among those who collectively must fill key staff and cockpit jobs and provide instruction and leadership to newcomers in operational and training units. Because almost all new pilots must be assigned to operational units, experience levels in these units will continue to decrease.

Our analytical model of the training required in operational units indicates that fighter squadrons may need up to 25 percent more flying hours to provide continuation and upgrade training as they lose experienced pilots and gain inexperienced ones. Although inexperienced pilots need more flying hours than do experienced pilots, an experienced, qualified pilot must provide essential supervision and thus must fly as part of virtually every flying training activity. As

squadrons include more newcomers and fewer experienced pilots, each experienced pilot must fly more to oversee and develop the inexperienced pilots. Our model runs confirmed that units with experience levels¹ below 60 percent cannot distribute sorties uniformly to all assigned pilots.

Consequently, unless sorties and flying hours are increased, each inexperienced pilot will fly a smaller share of the squadron's sorties as newcomers replace experienced pilots. This creates an *aging rate deficit* (ARD), or slowdown in the inexperienced pilots' accumulation of training and experience. Deficits of even one or two flying hours per month exacerbate the experience problem—inexperienced pilots then take longer to become experienced. Recent Air Force objectives were to ensure that operational fighter units kept the experienced portion of their squadron-assigned (RPI-1) pilots above 45 percent, with an "absolute" minimum of 40 percent. When ARDs are taken into account, however, our analysis indicates that it will be extremely difficult to stabilize experience near these levels. There aren't enough sorties to allow inexperienced wingmen to age fast enough [without a sizable sortie or aircraft utilization rate (UTE) increase] to keep the unit from becoming even less experienced. Even if there are enough pilots to fill all of the cockpits, the experience problem is serious enough to compromise the ability of fighter units to accomplish their primary missions and meet their Air Expeditionary Force (AEF) demands.

There are only a few options to alleviate the experience problem. The most obvious is for units to fly more, but the additional flying hours need to be programmed into the Air Force budget. This difficult and time-consuming process is complicated by the recent inability of fighter units to generate enough training sorties to fly their currently programmed hours. Reduced UTE rates have been dropping for several reasons: reduced funding for engines and other

¹A unit's experience level is basically the percentage of its assigned pilots who are experienced. Although pilot experience is formally defined in terms of hours flown, the majority of pilots meet this requirement near the end of their initial operational flying tour. Thus (in layman's terms) an experienced pilot is one who has completed an operational assignment in the unit's primary mission aircraft. Our experience level calculations include only the unit's *primary* assigned pilots [those with a rated position indicator (RPI) code of RPI-1]. The excluded pilots carry supervisory (or staff) RPI codes and cannot be inexperienced.

spare parts, reduced depot support, and lower experience levels for the flightline maintenance personnel responsible for generating the sorties.

If the Air Force cannot program and fly more hours, the only assured solution is to reduce the number of new fighter pilots absorbed each year into operational units, a notion that is counter to correcting its largest peacetime pilot shortfall. Such a policy would provide a reasonable long-term solution only in combination with improved retention and reduced requirements. The Air Force is indeed examining expanded pilot bonus opportunities and other retention initiatives, and it is also investigating alternative manning options, but it is unlikely that the shortfall and resulting experience problem can be corrected by these initiatives alone. Because operational units in the Guard and Reserve have much higher experience levels than active units, we were drawn to look at Total Force alternatives.

We examined several options. The first was a follow-on to PROJECT SEASON, a program implemented in the early 1980s in response to the last serious peacetime pilot shortage. The others involve using Guard and Reserve pilots in associate instructor pilot (Associate IP) programs that could free additional experienced active duty pilots for other assignments. All of these programs need to be evaluated in the context of increasing manning problems for Guard and Reserve units.

The first option sends new active duty pilots to Guard or Reserve units to gain experience there. This opens more cockpits for experienced pilots in active squadrons, maintaining a higher experience level while increasing the reserve components' responsibility for absorbing and training new pilots. The ratio of newcomers to experienced pilots in Guard and Reserve units would remain low, but the units would require additional resources to provide the training and supervision required by the additional active duty pilots. If some 40 inexperienced fighter pilots per year were absorbed in Guard and Reserve units, it would correspond to a UTE increase of sufficient magnitude to eliminate the aging rate deficit.

Associate programs that place experienced reserve pilots in active units can increase the number of available experienced pilots and help to alleviate the overall shortfall. Associate IP programs in un-

dergraduate flying training (UFT) units and Formal Training Units (FTUs) are also appealing because they fill cockpit requirements with experienced pilots. These alternatives show promise, but they must be implemented carefully and evaluated thoroughly to deal with cultural issues and prevent unintended consequences.

Guard and Reserve units themselves face a dynamic recruiting and retention challenge. Many pilots will leave the active component and be available to join reserve-component units within the next two or three years, but then the active component's smaller cohorts will begin coming to the end of their service commitments. Effective implementation of Associate IP programs requires that they move now to take advantage of the "window of opportunity" presented by the current profuse losses from active duty. Once the separation-eligible cohorts become smaller, the hiring pool will dwindle, and it will be too late to implement these programs.

The same window of opportunity could provide additional supervisors for active-component pilots involved in a Total Force exchange. If participating Guard and Reserve units received additional manning and grade authorizations, they could hire separating instructor pilots as overages² to provide some of the required supervision. Pilots in this category could also provide a hedge against hiring difficulties that the Guard and Reserve might expect when active duty loss rates drop off.

The results of our analysis were considered in the Four-Star Rated Summit that the Air Force convened in April 1999. The following actions were among the policy decisions resulting from that summit:

- Set 55 to 60 percent as the low-end experience-level goal for fighter units
- Reduced fighter FTU production to 330 per year, with 30 new pilots to be absorbed in Guard and Reserve units

²In order to hire these pilots, the units would require approval to exceed existing manpower (and grade authorizations).

- Supported the UFT Associate IP program
- Examined the feasibility of using Associate IPs in FTUs.

These are essential steps to prevent the lack of experience problem from becoming unmanageable. It is important to recognize, however, that retention must improve significantly and alternative manning options must be effective if production levels are to be sustained at 330 fighter pilots per year. We hope the Air Force will pursue the Total Force initiatives despite the implementation problems.

These policies can be effective, however, only if the UTE rate problem is resolved in time to ensure that operational units will be able to fly their programmed flying hours starting in FY00. If the units underfly by as little as two hours per crew per month (on average), the aging rate problem remains and experience falls to unmanageable levels.

ACKNOWLEDGMENTS

This research could not have been conducted without the full cooperation of agencies from the Air Staff, Air Combat Command (ACC), and the Air National Guard (ANG). We owe special thanks to our primary points of contact in those organizations: Brigadier General Bob Elder in ACC, Colonel Greg Flierl in AF/XOOA, and Colonel Keith Coln in the ANG.

We also received enthusiastic support from a number of organizations that we contacted and visited in the course of our study: active units at Shaw, Davis-Monthan, Hill, and Moody Air Force Bases; ANG units at McEntire, Albuquerque, and Tucson; plus Air Force Reserve elements at Carswell, Shaw, and Langley. Throughout our effort we enjoyed continued cooperation from offices in the Air Staff (RE, AXO, REO, REX, DPFF, and XOOT), the ACC staff (XO, DP, XOF, XOFG, XOFT, and XPXB), as well as the Air Force Personnel Center.

We thank the members of the Rated Management Task Force for the unique and varied perspectives plus the depth and breadth of knowledge they brought to discussions of the relevant issues.

Our RAND colleague, Harry Thie, reviewed an early draft documenting the research presented in this report, and his suggestions for organizing and presenting the material were extremely useful.

We also reserve special thanks for Colonel Blair Ellis, ACC's Director of Personnel; Colonel Russ Frasz, the Air Staff's Chief of Rated Force Policy; and Lieutenant Colonel Mike Turner, the ANG's Aircrew Manager. Without their wholehearted support, we would never have been able to gain access to essential data and information.

ABBREVIATIONS AND ACRONYMS

ACC	Air Combat Command
AD	Active Duty
ADSC	Active Duty Service Commitment
AETC	Air Education and Training Command
AFE	USAFE, U.S. Air Forces, Europe
AFPC	Air Force Personnel Center
AFR	Air Force Reserve
AGR	Active Guard/Reserve
ANG	Air National Guard
ARD	Aging Rate Deficit
ASD	Average Sortie Duration
B-Course	FTU Training, Basic Course
BMC	Basic Mission Capable
CMR	Combat Mission Ready
CR	Crew Ratio
CSAF	Chief of Staff of the Air Force
DACT	Dissimilar Air Combat Training
DOC	Designated Operational Capability
DOS	Date of Separation
FAIP	First Assignment Instructor Pilot
FL	Flight Lead

FRAT	Fighter Reserve Associate Test
FS	Fighter Squadron
FTU	Formal Training Unit
FY	Fiscal Year
GCC	Graduated Combat Capability
HARM	High-speed Antiradiation Missile
HCM	Hours per Crew per Month
IP	Instructor Pilot
IR	Infrared
LANT	LANTIRN
LANTIRN	Low Altitude Navigation and Targeting, IR Night
MDS	Mission, design, series
MQT	Mission Qualification Training
OJT	On-the-Job Training
PAA	Primary Aircraft Authorization
PAF	PACAF, Pacific Air Forces
PCS	Permanent Change of Station
PMAI	Primary Mission Aircraft Inventory
RAP	Ready Aircrew Program
RMTF	Rated Management Task Force
ROPMA	Reserve Officers Promotion and Management Act
RPI	Rated Position Indicator
SEAD-A	Suppression of Enemy Air Defenses-Antiradiation
TX	FTU Recurrency Training, Experienced Pilots
UFT	Undergraduate Flying Training
UPT	Undergraduate Pilot Training
UTE	Aircraft Utilization Rate

THE PILOT SHORTAGE

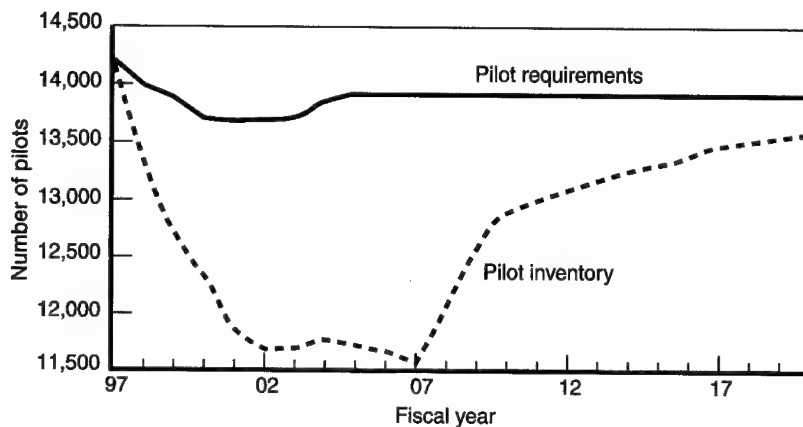
The Air Force is facing a pilot shortage that is unprecedented in its peacetime history. As shown in Figure 1.1, the 1999 shortfall exceeded 1200 pilots (over 8 percent of the requirement) and by FY2002 is projected to grow to about 2000 pilots, almost 15 percent of the total requirement.¹ The next most serious peacetime pilot shortage, which occurred in 1979, was only 5.6 percent of the requirement. The current pilot shortage already exceeds that shortfall, and it is projected to become over twice as bad as it was during the "Hollow Force" period.

THE ORIGIN OF THE SHORTAGE

The steep downward slope of the left side of the inventory curve in Figure 1.1 reflects the high loss rates the Air Force has experienced over the past three years. Since FY1997, the loss rate for pilots reaching the end of their initial active duty service commitment (ADSC) has averaged close to 70 percent, higher than it has ever been except in periods of demobilization or drawdown. Also unprecedented is the loss rate for pilots who have reached their 15th year of service but are not yet eligible for retirement. They are now exiting at a rate of almost 25 percent. The previous high for this group was

¹Air Force sources (DP and XO) provided most of the data in this chapter. The inventory projection is current as of January 1999. Actual data are used for FY1997 and FY1998. See also Department of the Air Force (January 1999).

2 The Air Force Pilot Shortage



NOTE: Assumes 1100 new pilots per year.

Figure 1.1—Pilot Inventory Is Dropping Sharply and Remains Below Requirements

7 percent during the drawdown when pilots were offered monetary incentives to separate from the service. Previously, loss rates were between 1 and 2 percent.² These two groups—i.e., pilots at end-ADSC (typically in the 10th year of service³) plus pilots at the end of their bonus-payback period (typically in the 15th year)—generate the losses that represent the primary pilot retention concerns for the Air Force. The combined effect since FY1997 is that three pilots have left active duty for every two new pilots that the Air Force has trained.

The relatively flat portion of the inventory projection between FY02 and FY07 indicates that net losses no longer predominate. Rather

²The pilot bonus implementation in 1989 paid recipients through the completion of 14 years of service under the assumption that this would virtually ensure that they would complete 20 years of active duty to reach retirement eligibility. The pilot losses in this group are now occurring as pilots complete their “bonus-payback” obligation. New bonus proposals include additional options for this group.

³This becomes the 12th year for those with a 10-year ADSC. The ADSC is based on years of *rated* service (which is measured from completion of pilot training), whereas pay, promotion, and retirement computations all normally use years of *commissioned* service. Most Air Force pilots earn their pilot wings in their second year of commissioned service.

than reflecting any improvement in the retention problem, it reflects the small sizes of the pilot training cohorts that are reaching the end of their initial ADSC. These cohorts completed training during the drawdown when there was a pilot surplus and the number of new pilots was kept well below the levels that would sustain the pilot inventory. Some of these cohorts contained fewer than 500 pilots, so loss rates can remain high (at 70 percent, say) while generating many fewer total losses than experienced recently. Conversely, the small sizes of these cohorts also mean that improved retention for this group cannot significantly reduce the pilot shortfall. On the other hand, the pilot cohorts reaching the end of their bonus-payback period remain fairly large, so influencing their retention behavior may become increasingly important.⁴ Indeed, many of these pilots turned down monetary incentives to separate during the drawdown, so their extremely high loss rates were not anticipated. When the pilot training cohorts were cut during the drawdown, Air Force decisionmakers recognized that there would be a future pilot shortage. Without the unprecedented loss rates, however, this shortage would have been manageable.

The climb in the inventory curve that begins in FY2007 does not result from improved retention or lower loss rates. Rather, it reflects the Air Force's estimate of the effect of increasing the ADSC from 8 years to 10 years.⁵

THE NATURE OF THE SHORTAGE

Because more than 16 percent of Air Force pilot requirements are nonflying staff billets (2245 of some 13,800 total billets), it might appear that the projected shortfall (less than 15 percent, or about 2000

⁴Reducing the 25 percent loss rate in a 1500-pilot cohort reaching the bonus-payback point, for example, can have as great an effect on the shortfall as reducing the 70 percent loss rate in a 450-pilot cohort reaching end-ADSC.

⁵By January 2000, the Air Force had revised inventory projections with slightly improved retention based on lower FY1999 loss rates and the expected effect of more-liberal pilot bonuses in FY2000. The lower loss rates may have been contaminated by the Kosovo "stop-loss" order, which prevented pilots from exiting voluntarily for a good portion of the year. The inventory curve was used by the Rated Management Task Force as well as by the decisionmakers at the Four-Star Rated Summit, so it seems appropriate to include it in this report.

pilots) could be absorbed while still filling cockpits and flying units. Some argue that nonflying billets do not represent valid requirements, so simply removing these requirements will substantially mitigate any apparent crisis.⁶ Our analysis shows, however, that lack of experience can degrade the readiness and capability of operational units even if all the cockpits remain filled. We document these experience issues in Chapter Two of this report, but it is appropriate to note several pertinent facts here.

The Real Crisis Is in Fighters

First, half of the shortfall occurs in fighters, where the pilot shortage could approach 20 percent of requirements. Consequently, it would be difficult to distribute a 2000-pilot shortfall uniformly enough among the six weapon system categories⁷ to contain it within the 2245 nonflying staff billets.

Even if that could be achieved, the Air Force would be left with its nonflying staff billets unfilled. Since more than 400 of these billets are regarded as key joint billets (with a fill criterion of 100 percent), it becomes clear that absorbing the entire shortfall in nonflying staff billets will be extremely difficult. We also note that the Air Force reduced total pilot requirements by 39 percent during the past decade, while reducing nonflying staff requirements by 56 percent. Any padding that may have existed in staff requirements certainly has been substantially reduced.

The Shortage Consists Solely of *Experienced* Pilots

A related problem arises from the fact that the Air Force's exceptional losses have occurred only among experienced pilots (i.e., those who

⁶This view is a "key finding" in *The Readiness Crisis of the U.S. Air Force: A Review and Diagnosis* (Conetta and Knight, 1999), p. vii. Recalculating requirements is the primary recommendation in *DOD Aviator Positions: Training Requirements and Incentive Pay Could Be Reduced* (GAO, 1997), p. 9. This recommendation is reiterated in *Military Pilots: Observations on Current Issues* (GAO, 1999), p. 15, as well as *Military Personnel: Actions Needed to Better Define Pilot Requirements Promote Retention* (GAO, 1999), p. 60.

⁷The categories are fighters, bombers, tankers, strategic airlift, theater airlift, and helicopters.

have completed at least one operational tour in their mission aircraft), because only they are eligible to separate following their service commitments. Consequently, if the Air Force tries to remedy the shortage by increasing the production of new pilots, an experience imbalance may well result—production increases initially add only to the number of newly trained, or inexperienced, pilots in the inventory.

Better retention, on the other hand, will increase the number of experienced pilots. Production and retention are the traditional means of controlling inventory levels,⁸ so retention initiatives, especially among pilots reaching the end of their bonus-payback period, will remain critical to an acceptable policy resolution. It may also be useful for the Air Force to examine nontraditional remedies such as alternative manning options to deal with the pilot shortage. We explore some of these options later in this report, but we will first address some of the factors that influence pilot retention.

RETENTION ISSUES

The Air Force has polled exiting pilots to learn their reasons for leaving active duty. Responses indicate two primary causes. First are the negative effects of multiple deployments, frequent moves, family turmoil, and other quality-of-life issues. Second is the increasing appeal of commercial aviation, fed by an unprecedented hiring boom among major airlines. However, several changes have occurred in airline hiring that may affect the options available to the Air Force to deal with this problem. These changes affect the demographic distribution of new pilot hires for the airlines as well as influence their demand for pilots, a development that could end the boom-or-bust nature of their hiring cycles.

⁸For a more complete discussion of the interaction of these parameters, see *Total Force Pilot Requirements and Management: An Executive Summary* (Thie et al., 1995), or *A Critical Assessment of Total Force Pilot Requirements, Management, and Training* (Thie et al., 1994).

Major Airline Pilot Demographics

In the fall of 1999, fewer than 13,000 pilots were serving on active duty in the Air Force and there were fewer than 7000 pilots on active duty in the Navy. At the same time, the major airlines employed over 60,000 pilots, about 30,000 with "the big three": United, American, and Delta.⁹ The pool of available military pilots is shrinking in the face of increasing demand for commercial pilots among the major airlines. The major airlines have hired over 300 pilots per month on average for almost three years. These factors have caused the airlines to revise their hiring policies: They now hire fewer military pilots and more pilots from regional and commuter airlines. The proportion of new hires with military experience has dropped from over 90 percent to under 50 percent in a little more than a decade.

This shift of the major airlines from military to civilian sources has been by necessity, however, and it has not diminished their desire to hire military pilots. Indeed, it may well have focused their preference, for there is every indication that the major airlines will continue to embrace pilots with military experience. Our discussions with the airlines have indicated that military pilots have several advantages in the hiring process, including:

- The quantity and quality of their training can be readily verified.
- The variety and complexity of their flying experience are well documented.
- They have a traceable track record so that past problems cannot be easily hidden.
- Flying proficiency and commitment can be tracked via career progression.

⁹The major airlines have annual revenues of at least \$1 billion. Collectively, they represent the commercial carriers that hold a definite economic appeal for military pilots. Passenger-carrying "majors" include Alaska, America West, American, Continental, Delta, Northwest, Southwest, TWA, United, and US Airways. Cargo carriers include Airborne Express, DHL, Federal Express, and UPS. The information on commercial pilots in this discussion comes from the Federal Aviation Administration (FAA), Aviation Information Resources, Incorporated (AIR, Inc.), a commercial firm that tracks the airline industry, and the airlines themselves, in addition to Air Force sources.

Recently, many of the major airlines have essentially eliminated age limits for new pilots and lower pay scales for older candidates. Despite the FAA-mandated retirement age of 60 for commercial pilots, several major airlines have recently hired military retirees in their 50s.¹⁰

Recognizing the mutual benefits of this policy change, the Air Force has implemented a one-year test of the PHOENIX AVIATOR program, an attempt to defer, rather than discourage, airline careers for its pilots. This program helps active duty pilots who are approaching retirement eligibility to enhance their appeal to, and facilitate interviews with, the major airlines. The airlines have enthusiastically embraced this program, and many of them have agreed to guarantee employment interviews for participating pilots who meet eligibility requirements. The perceived probability of being hired by an airline appears to be a major factor in the stay-or-go decisions made by military pilots. Indeed, almost all military pilots hired by the major airlines have separated from active duty before they are hired. Retention of younger pilots may be increased by encouraging them to delay airline careers until they reach retirement, so this eligibility program certainly seems to deserve additional study.

Major Airline Pilot Demand

The demand for military pilots among the major airlines has always been a primary factor in the military services' ability to retain pilots on active duty.¹¹ This demand is essentially the sum of the airlines' pilot losses (primarily because of mandatory retirements) and growth in their requirements for pilots. We used AIR, Inc., data on expected retirement numbers and FAA estimates of airline industry growth to develop estimates of increases in pilot requirements.¹² Figure 1.2 depicts these estimates.

¹⁰We note that the major airlines are also hiring older civilian pilots, but these hires typically are not as old as the military retirees.

¹¹See *The Civilian Airline Industry's Role in Military Pilot Retention: Beggarman or Thief?* (Levy, 1995).

¹²The FAA provides annual estimates of growth in revenue passenger miles and equipment growth, but not specifically for growth in pilot needs. We used these

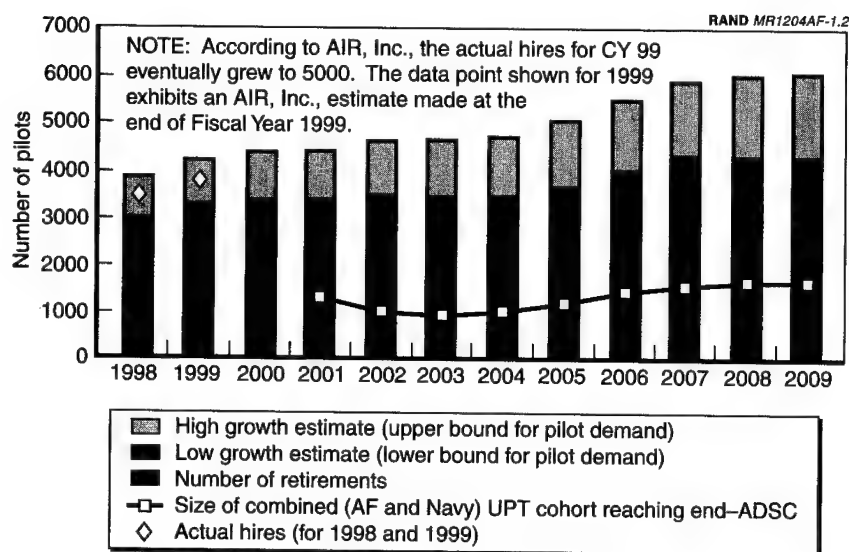


Figure 1.2—Airline Demand for Military Pilots Is Likely to Remain Strong

The annual retirement estimates from AIR, Inc., are plotted as the shortest bar in each three-bar stack. The other two bars add our lower and upper bounds for the numbers of new pilots hired each year. Thus, we expect the actual hires to fall in the range covered by the upper (shaded) bar. We tested our estimating procedure by comparing its 1998 and 1999 results with actual hiring data (denoted by the diamond-shaped data points in those two years). The solid

growth rates to set bounds for estimates in the corresponding growth in the number of pilots required by the major airlines. Growth in revenue passenger miles normally aids in establishing an upper bound for the growth in pilot requirements, because efficiency improvements in load factors can increase this parameter without requiring the number of pilots to increase proportionately. Equipment growth, on the other hand, traditionally helps to provide a lower bound for pilot needs, because the improvements in range, capacity, and ground time that are normally associated with new equipment typically translate into a need for more pilots per aircraft in addition to more pilots to operate the expanded numbers of aircraft. Our estimation methodology for both the upper bound and lower bound uses an adjusted average over several FAA forecasts to ensure that the estimates are reasonably conservative. Even conservative estimates will confirm our primary conclusion: there simply are not enough military pilots available to meet the projected demands of the major airlines.

curve near the bottom of the chart depicts the combined Air Force and Navy pilot training cohorts that reach the end of their initial eight-year ADSC in the years indicated.¹³ Figure 1.2 indicates that the current hiring boom for the major airlines is likely to continue unabated for the foreseeable future and present a problem for military retention behavior. The cyclical nature of the airline business has historically enabled the Air Force to cope with hiring booms by simply waiting for the next economic slowdown. However, matching projected growth rates for pilot demand with the reduced supply of military pilots indicates that the current major airline hiring boom is unlikely to resolve itself in this manner. Figure 1.2 also confirms that the airlines are likely to continue to aggressively pursue older pilots with military experience, because their normal supply of military pilots (i.e., those reaching the end of their initial ADSC) is so small.

These factors seem to indicate that the Air Force should examine options such as PHOENIX AVIATOR that can help to defer rather than discourage airline careers for its pilots.

¹³All information not credited to AIR, Inc., or the FAA was provided by the services. The Navy's pilot training numbers do not include those pilots training in rotary-wing aircraft. This group completed a distinct training program and had a shorter service commitment than did Navy fixed-wing pilots. Although the Air Force also sent small numbers of pilots to helicopters, they completed the identical undergraduate training program as did Air Force fixed-wing pilots during the time period under consideration and thus incurred the same ADSC.

Chapter Two

EXPERIENCE LEVELS IN OPERATIONAL UNITS: THE REAL ISSUE

We have seen that it may be difficult for the Air Force to ensure that its pilot shortage occurs only in its nonflying staff billets (i.e., without having cockpits go empty). However, dire consequences can ensue even if all cockpits can be filled. We address fighters only, where the most critical shortages exist. To function effectively, operational fighter units must have the proper experience mix, or see their readiness and combat capability degrade. The problem stems from the need for the units to ensure that newly trained pilots receive appropriate supervision until they gain essential experience.

We begin by developing the framework on which our analysis is based, and then we show that *in*experience in operational units¹ can truly feed on itself. Finally, we examine alternatives to deal with the problem.

THE ANALYTIC FRAMEWORK

Before we describe the quantitative model that provides the starting point for analysis, we discuss some definitions and parameters that govern pilot experience and define experience levels in operational units.

¹Operational fighter units in the Air Force have combat rather than formal training or test-and-evaluation missions. Operational fighter units are those tasked to conduct combat operations.

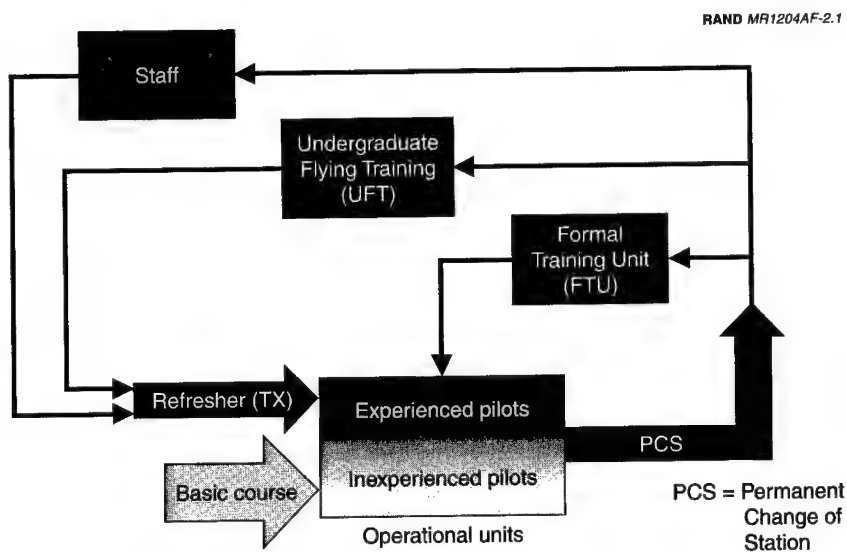
Experience and Inexperience

Inexperienced pilots are still learning their units' missions and require constant supervision. They fly in operational units as wingmen (in fighter units) or copilots (in bomber or transport units) under the direct supervision of a flight lead or aircraft commander. Experienced pilots understand their units' operational missions, and although the definition of experienced pilots varies by aircraft type, most require pilots to complete the better part of an initial operational tour (30 to 36 months) to qualify as experienced. The basic criterion for a fighter pilot, for example, is 500 hours in the mission aircraft. Formal training requirements and programmed flying rates imply that most new pilots need over two and a half years of operational flying to accumulate 500 hours, so becoming experienced in fighters essentially requires a three-year "residency" program. Cockpit jobs for experienced pilots include aircraft commanders, flight leads, and instructors. Only experienced pilots can be assigned to staff jobs, which require knowledge of operational missions that inexperienced pilots do not possess. Moreover, diverting the attention of new pilots away from their operational mission would only slow their development.

The flows of fighter pilots through training, operational, and staff assignments are depicted in Figure 2.1.

New, inexperienced pilots are produced through the basic course (B-Course) in fighter formal training units (FTUs). Upon B-Course graduation, the new pilots can go only to operational units (all other jobs require experienced pilots). These pilots become experienced, typically during their initial operational tour, and then are reassigned to billets that normally require only experienced pilots: FTU instructor, undergraduate flying training instructor, or flying or nonflying staff assignment.²

²The primary Air Force flying units are operational units and training units (we ignore operational test and evaluation units, which employ relatively few pilots). Training units include both formal training units (FTUs) that provide training in mission aircraft and undergraduate flying training (UFT) units that provide fundamental training in special training aircraft. These billets require experienced pilots only. A minor exception allows a small percentage of UFT graduates, called first-assignment Instructor Pilots (IPs), or FAIPs, to remain as instructors for their initial flying tours. Their eventual weapon system has been determined at this point, and their next



SOURCE: Adapted from an AFPC presentation.

Figure 2.1—Flow of Fighter Pilots

Experienced pilots arrive in operational units from three sources:

- After becoming experienced during this (or an immediately preceding) operational tour.
- After completing an FTU IP tour.
- After completing an FTU refresher training (TX) course if not currently qualified in the unit's primary mission aircraft.

A perfect system would ensure that production levels met future pilot needs (using current retention forecasts). Production levels should increase if a shortage is forecast. As long as enough newcomers are available to enter pilot training, shortages always occur first for experienced pilots. But production levels must be constrained to

assignment will be in an operational unit to learn its mission. As a result of their instructor experience, they become experienced faster (usually in about 18 months) during their first operational tour of duty. We assume 65 FAIPs per year among fighter pilots.

maintain acceptable experience levels in the operational units. This is called the *absorption* problem (because only a limited number of new pilots can be absorbed in operational units), and balancing production requirements with absorption constraints is a fundamental problem in the management of rated officers.³

If there are too few experienced pilots to fill cockpits, many would regard the system as badly broken because no viable choices remain available. Two problems arise if cockpits go empty in the operational units. First, unit readiness and operational capability would degrade immediately. Second, absorption problems would worsen because fewer experienced pilots would be available to supervise the development of the new and inexperienced pilots the units would need to absorb. But if cockpits go empty in the training units, then production requirements could not be met at a time when shortages were getting worse, exacerbating the shortage itself.

The Problem with Decreasing Experience

If there are enough experienced pilots to fill the cockpits, then the overall experience level—the percentage of Rated Position Indicator (RPI)-1 pilots who meet the definition of “experienced,” is determined solely by production levels (i.e., the annual output from the basic course).⁴

The primary result from RAND’s operational unit training model⁵ is that the cost of maintaining new pilots’ skills increases as experience levels in the operational fighter units drop. Smaller numbers of flight leads and instructors each must fly more to supervise larger numbers

³See the *Rated Management Primer* for a more complete treatment of this issue.

⁴We also assume that the operational units, whose RPI-1 pilot authorizations can be calculated as the product of their primary aircraft authorizations (PAA) times their authorized crew ratios, are not manned at more than 100 percent, because this would exacerbate the shortfall and increase the need for sorties. Another imbedded assumption is that the pilot assignment process can distribute experienced and inexperienced pilots uniformly among units so the experience level for individual fighter units is basically the same as the aggregate experience level across all fighter units. In practice, controlled tour lengths in overseas units and special rules for remote tours often cause stateside units to have slightly less experience than other operational units.

⁵See Appendix A for a brief overview of the model’s underlying concepts.

of wingmen. The additional sorties flown may far exceed the individual experienced pilots' requirements. Our model reveals this fact, well known qualitatively to schedulers and supervisors, because it quantifies the training needs for the entire squadron instead of simply summing individuals' requirements. The problem was reflected in neither the Ready Aircrew Program (RAP) training documents nor the budgetary programming process, both of which arrive at unit totals by summing the totals required by individuals. RAP tasking messages, for example, require that inexperienced pilots fly more sorties per training period than experienced pilots, but our model shows that this is possible only for units with high experience levels.

Preliminary Results

We have exercised the operational unit training model under a variety of conditions to explore fundamental relationships. The results reported here reflect conditions for a notional 18-PAA F-16 LANTIRN⁶ squadron that also has a Killer-scout tasking. Other circumstances yield similar results. Our first objective is to determine the monthly sortie requirements for pilots with different qualifications to ensure that the unit's assigned pilots are fully qualified and completely trained to accomplish every mission or activity for which they have been certified.⁷ As discussed previously, we could determine individual requirements in an absolute context, but in quantifying unit needs the more highly qualified individuals (typically represented by those with more experience) must fly more sorties than they need to maintain their individual proficiencies. For ease of presentation, we group the pilots into four categories and tabulate the sorties required to meet individual needs plus those

⁶Low Altitude Navigation and Training, IR Night.

⁷Designated Operational Capability (DOC) statements and RAP tasking documents delineate unit taskings. Pilot qualifications are certified by each unit commander and published in a "Letter of X's." Experts in operational units and at Air Combat Command headquarters helped ensure that these qualifications are realistic throughout the experience range we investigate.

required to meet unit needs for two disparate levels of experience.⁸ The results are in Table 2.1.

Similar information is depicted in Figure 2.2. We note that flight leads and IPs must fly more sorties than they require individually even when the unit experience level is 65 percent, a relatively high level that Air Force fighter units last encountered in 1996, the year before the pilot losses became acute. Even more important is the dramatic 44 percent sortie increase required for flight leads and IPs when the experience level drops to 40 percent. Most important of all, however, is the increase from 13.1 sorties per CMR pilot per month required to ensure proficiency for everyone at an experience level of 65 percent to the requirement of 15.7 sorties per pilot per month to ensure proficiency at a 40 percent experience level. This increase occurs solely in the flight leads and IPs, whereas sortie needs per inexperienced pilot do not increase at all.⁹ The notional squadron would need to increase its monthly sortie production by almost 20 percent if its experience level dropped to 40 percent from 65 percent *just to*

Table 2.1
Training Needs Depend on Pilot Qualifications and
Unit Experience Level

Pilot Type	Individual	Unit @ 65%	Unit @ 40%
Inexperienced CMR	13.2	13.2	13.3
Experienced CMR	12.4	13.0	17.6
Flight lead/IP	12.5	13.0	18.0
CMR average	NA	13.1	15.7

⁸We have aggregated RPI-1 combat-mission-ready (CMR) qualified pilots only. Our primary categories are experienced pilots and inexperienced pilots, because these two categories define unit experience levels. We listed flight leads and instructor pilots separately to confirm that their results track closely with the experienced category. Finally, we listed the unit average to quantify the increased number of required sorties as experience drops (no average is listed in the "Individual" column because unit needs cannot be determined by summing individual requirements). The two levels of unit experience shown (65 percent and 40 percent) represent the upper and lower experience bounds anticipated by the Air Force while we were conducting our analysis. We calculated individual training needs by running the model for a unit containing a single pilot without imposing supervisory constraints.

⁹The sortie requirement per inexperienced pilot does not increase, but the larger number of inexperienced pilots does need more sorties collectively.

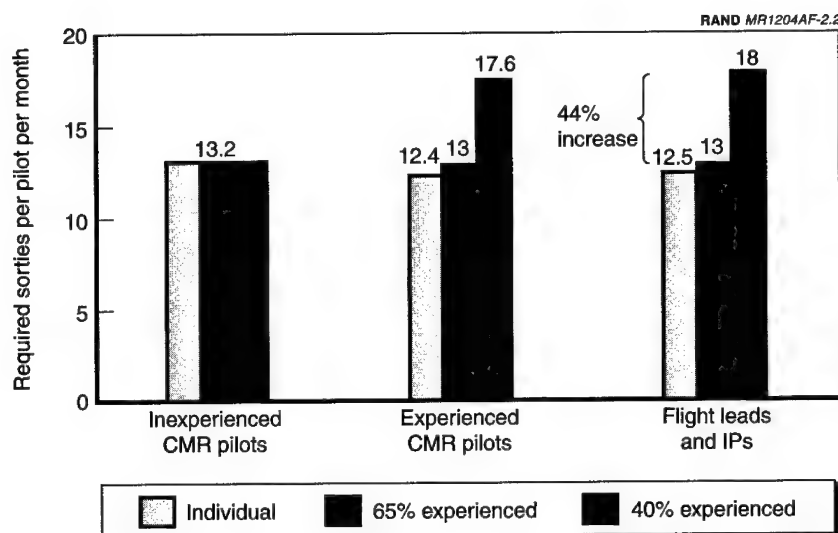


Figure 2.2—Sortie Requirement Increases Generated by Reduced Experience in Fighter Squadrons

ensure that the inexperienced wingmen flew enough sorties to maintain their flying skills. This is because the fewer flight leads and IPs each must fly more sorties to supervise the increased number of inexperienced pilots who fly primarily as wingmen. If more sorties were not flown, the inexperienced wingmen each would fly fewer sorties than they need to maintain adequate skill levels to meet the tasking for which they are certified.

Aircraft Utilization (UTE) Rate Constraints (Why the Required Sortie Increase Cannot Be Flown)

In practical terms, each unit can fly only a fixed number of sorties—its aircraft authorization is fixed and specific constraints currently limit UTE rates.¹⁰ UTE rates are constrained for several reasons: reduced funding for engines and other spare parts, reduced depot sup-

¹⁰A fighter squadron's UTE rate is the number of sorties per authorized airframe per month.

port, and lower experience levels for flightline maintenance personnel and the resulting degraded capability to generate aircraft sorties. Additional sorties require additional flying hours and corresponding budget authority. Owing to the UTE constraints noted above, fighter units have recently been unable to fly their programmed hours. It seems unproductive for Air Force planners to take the time and trouble to find the tradeoffs necessary to program more flying hours when it appears unlikely that additional hours could be flown.

If experience levels continue to drop, the Air Force can expect experienced flight leads and IPs individually to require an ever-increasing number of sorties to provide essential supervision to an increasing number of inexperienced wingmen. But if sortie production and UTE rates remain fixed, more inexperienced wingmen will compete for a shrinking number of available training sorties, so each inexperienced wingman will fly fewer sorties in any given training period. Because becoming an experienced pilot normally requires 500 hours in the mission aircraft, the inexperienced pilots—flying fewer sorties (and therefore hours) per training period—will take longer to become experienced. Thus, they will remain inexperienced longer and develop (or “age”) more slowly.

INEXPERIENCE FEEDS ON ITSELF IN FIGHTER UNITS

The Aging Rate for New Pilots

To analyze the effect of unit experience levels on the rate at which inexperienced pilots develop (or age) to become experienced pilots, we ran the model using various experience levels to determine the proportion of a unit's sorties that would be flown by IPs and flight leads, comparing them with the proportion of sorties flown by inexperienced wingmen. These results are summarized in Figure 2.3.

At experience levels below about 60 percent, flight leads and IPs individually must fly more than inexperienced wingmen. The intersection of the two curves identifies a parity threshold or breakeven point—the lowest experience level at which inexperienced wingmen can average the same number of sorties each month as the flight leads and IPs. If the unit's experience level falls below the breakeven point, the average number of sorties for each inexperienced pilot

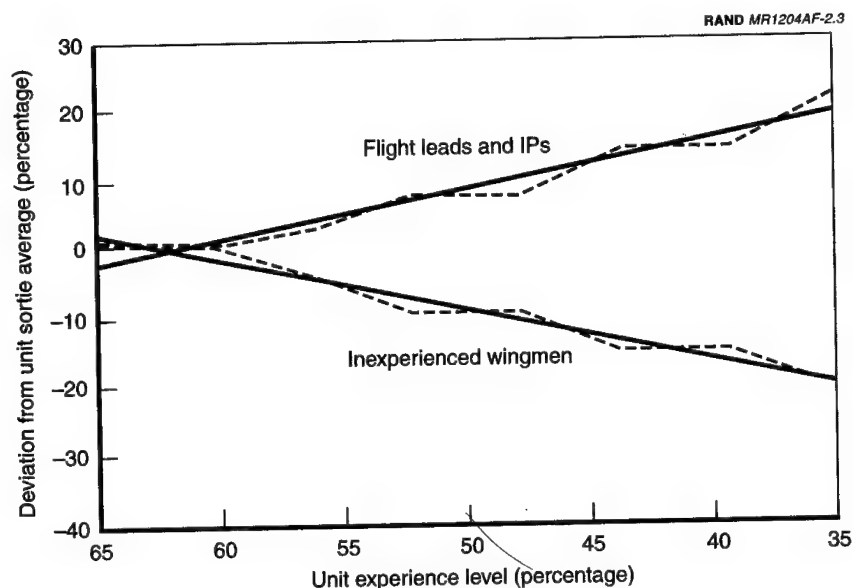


Figure 2.3—Inexperienced Wingmen Lose Sorties Proportionately as Unit Experience Drops

must be fewer than the average for the unit. The vertical axis in Figure 2.3 shows (in percentage terms) how much below the overall unit average inexperienced pilots will average (and how much above the unit average flight leads and IPs will each fly). The unit's "aging rate," the rate at which new pilots accumulate experience (calculated as the average number of hours per month flown by inexperienced wingmen), is less than the unit's average taken over all of its RPI-1 pilots.¹¹ This overall average is an important programming parame-

¹¹ Fighter pilot experience is defined in terms of hours, rather than sorties, so it is necessary to convert our model output, which is expressed in sorties, to hours. This is readily accomplished by multiplying by the average sortie duration (ASD). When we calculate the proportion of hours flown by inexperienced wingmen (or by flight leads and IPs), this simple scaling factor appears in both the numerator and denominator and drops out of the calculation. Thus, the same proportions shown in Figure 2.3 remain valid for hours as well. The sharp corners in the graph correspond to individual decisions that could be made by a unit commander. These anomalies would average out over multiple units, so we performed a linear smoothing operation to represent the average over a number of similar units. The linear approximations are quite good

ter for operational units, and flying hours are budgeted by MDS based on a specified RPI-1 average number of hours per crew per month (or HCM) that is required across all active units with the same MDS. Active F-16 units in FY1999, for example, were programmed to fly an average of 17.1 HCM. A-10s and F-15Es were programmed to fly a slightly higher average HCM, and F-15Cs were programmed at slightly less.

The Aging Rate Deficit

The Air Force imposed absorption constraints upon projected fighter-pilot production assuming that inexperienced pilots would age at the programmed HCM for their respective MDS. Figure 2.3 indicates that when experience levels drop below 60 percent, however, inexperienced pilots cannot age at the unit's average flying rate. Thus, even if units flew their programmed rates, new pilots would age more slowly than expected. We use the information in Figure 2.3 to calculate potential aging rates over a range of experience levels under the assumption that fighter units can fly at their programmed rates.¹²

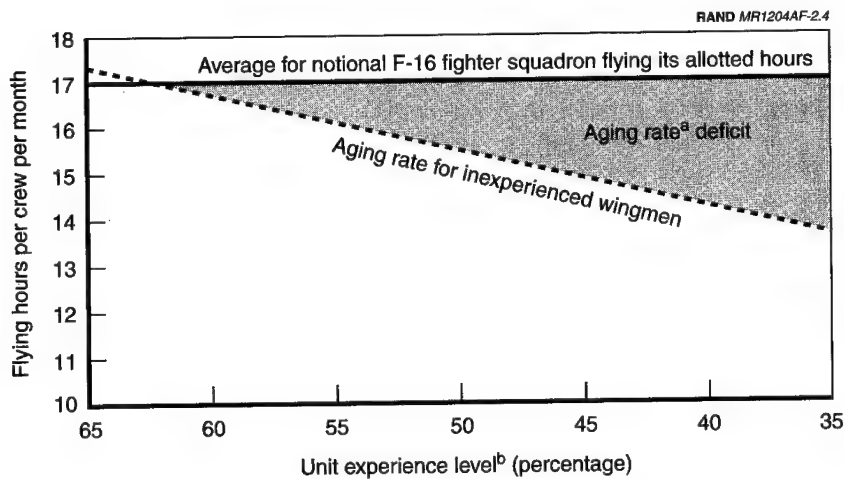
Figure 2.4 shows what happens to a unit's aging rate if it continues to fly its programmed RPI-1 average while its experience level drops below 60 percent.

The horizontal line at 17.1 hours represents the monthly average for RPI-1 pilots in a notional F-16 squadron that flies its programmed HCM. The sloping line exhibits the aging rate for such a squadron.¹³

for an experience range below 60 percent, which represents our primary region of interest. The curves shown are for an F-16 LANTIRN unit, but other mission, design, series (MDS) designations and other mission demands exhibit similar behavior. A slight bend, or "knee," in both curves in this range causes the linear approximations to intersect at a higher experience level (about 62 percent) than the actual intersection, which occurs at an experience level just under 60 percent.

¹²Even though units recently have been unable to fly at their programmed rates, it seems that this should be addressed independently from the absorption problem, and we are willing to assume for now that the programmed rates can be flown.

¹³Here the terms "squadron" and "unit" refer to average, or generic, units within an MDS. We could just as easily interpret this as an average across the MDS. In fact the curves that we develop represent an aggregated average across all absorbing fighter MDS (all active versions of the F-16C; the F-15C and F-15E; plus the A/OA-10).



^aAging rate = Rate at which new pilots accumulate experience.

^bUnit experience level = Percentage of assigned pilots who are experienced.

Figure 2.4—The Aging Rate Drops Rapidly as the Experience Mix Falls

at various experience levels. The vertical distance between the two lines represents the difference from the RPI-1 average in average monthly hours for the inexperienced wingmen. This difference, called the *aging rate deficit* (ARD), reflects how far below the squadron average (in HCM) the inexperienced wingmen average per month. For example, at a 50 percent experience level, the squadron can expect a deficit of about one and one-half HCM from the RPI-1 average, but at 35 percent experience the deficit grows to about three-and-one-third hours. A squadron that has a positive ARD cannot turn inexperienced pilots into experienced ones at the programmed rate, even when it flies its programmed HCM. As a result, the unit's experience level will drop over time to lower levels than Air Force planners expected. If we know the size of the ARD, we can calculate how much longer it takes inexperienced pilots to become experienced and determine the size of the drop in a unit's experience level over time.

THE SLIPPERY SLOPE

Figure 2.5 shows that, if the aging rate deficit is ignored, the notional squadron's experience over time appears to approach a steady-state value. To show the effect of the ADR, we use multiple runs of the ACC pilot distribution model to produce steady-state experience levels and average time-on-station as outputs. From a given set of input conditions, we can calculate the proportional change over a specific period in moving toward the steady-state conditions, and with each run of the Air Combat Command (ACC) model, use updated input parameters from the RAND model.

When we apply the aging rate deficit in this way to estimate the unit's experience level over time, a different picture emerges. Figure 2.6 shows that instead of approaching a steady-state level, the experience level drops quickly below the expected steady state as though it encounters a "slippery slope."

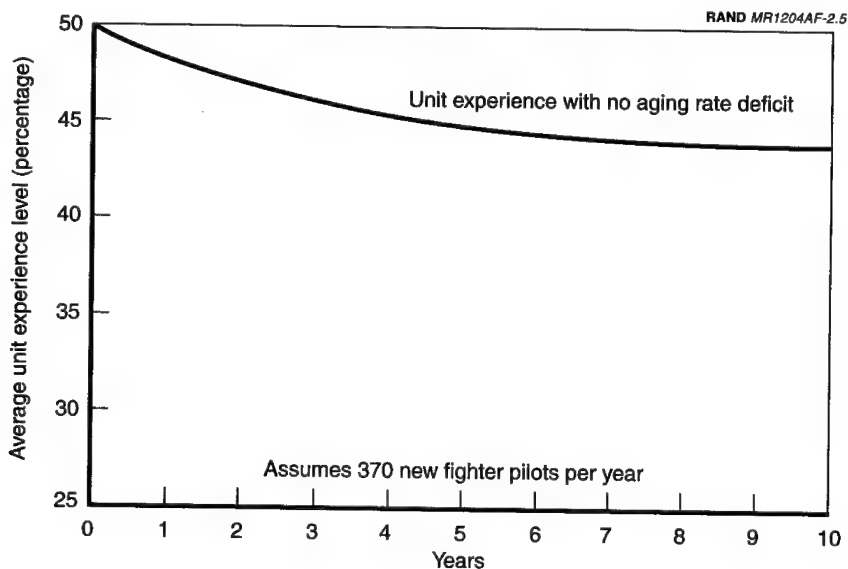


Figure 2.5—If the Deficit Is Ignored, Experience Appears to Approach a Steady-State Value

The lower line in Figure 2.6 makes it clear that unit inexperience can feed on itself. Because inexperienced pilots age slower as unit experience drops, unit experience continues to drop. In turn, the aging rate continues to slow, the aging rate deficit increases, and newer incoming pilots stay inexperienced even longer. This process eventually takes unit experience below 25 percent in our calculations.¹⁴

Air Force leaders fully understand the inherent problems that await fighter units attempting to operate at experience levels depicted on the dotted (or lower) line in Figure 2.6. Such low experience levels have previously occurred only in wartime where strong evidence

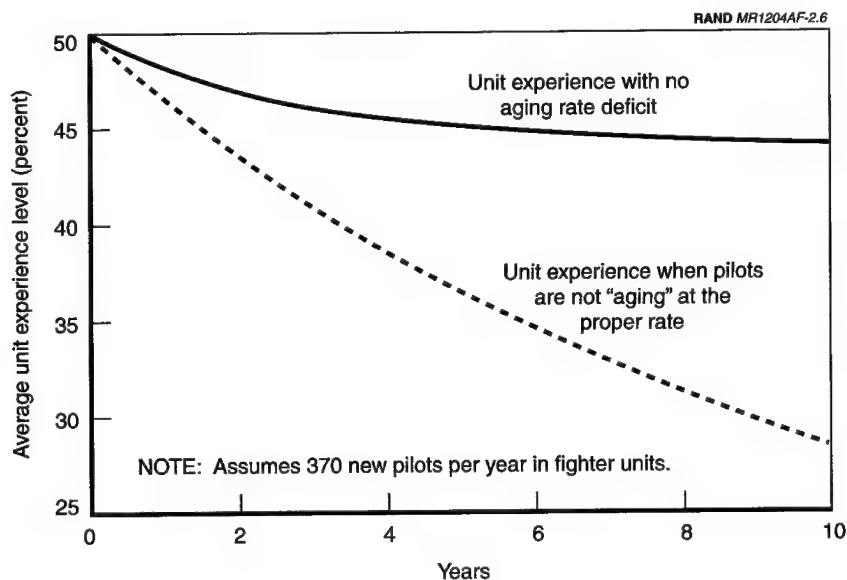


Figure 2.6—In Reality, the Aging Rate Deficit Yields a “Slippery Slope”

¹⁴These input conditions provide the initial conditions, or starting point, for our experience projections. The production of 370 new fighter pilots per year is what is necessary to sustain fighter pilot requirements, and this production number was set to become official policy in FY1999. As is shown in Figure 2.5, this would generate a collective steady state experience level of between 40 percent and 45 percent for the operational fighter units, so we started our projections at a collective experience level of 50 percent

indicates that low experience generated higher losses than can be directly attributable to enemy action in combat. To better appreciate the nature of the experience problem, consider the following examples:¹⁵

- When a unit has two wingmen for every flight lead (~33 percent experienced), each flight lead essentially must fly twice as many sorties (and hours) as each wingman. If the squadron averages 17 hours per pilot (essentially its program), for example, the inexperienced wingmen will fly three quarters of the average (~12.75 hours), while the flight leads will average 1.5 times the average (~25.5 hours).
- This means that if inexperienced pilots become experienced in 32 months flying the programmed average (two years, eight months is normal for units flying their program), it will take $4/3 \times 32$ months, or over 42 months to become experienced at a 33 percent experience level. A pilot will still be over six months short of reaching 500 hours at the end of a notional three-year initial operational tour.
- At a 25 percent experience level (three wingmen for every flight lead), the programmed 17 hours would give wingmen $2/3$ of 17 (or $11 \frac{1}{3}$ hours) and flight leads $6/3$ times 17, or 34 hours. The latter corresponds to over 24 sorties to be flown in about 20 flying days per month.
- In the 25 percent situation, it takes 50 percent longer to reach 500 hours, so instead of becoming experienced in about two and two thirds years, it would take four years, and the pilot is nowhere near experienced at the notional tour end of three years.

These examples assume that a pilot becomes experienced at 500 hours regardless of the rate at which the time is accumulated. In actual units, there is evidence that the proficiency of new pilots deteriorates more rapidly than for experienced pilots.¹⁶ When new pilots do not fly often enough, their flying skills degrade so that additional

¹⁵The formulas used in these examples are derived in Appendix B.

¹⁶See John Stillion, *Blunting the Talons: The Impact of Peace Operations Deployments on USAF Fighter Crew Combat Skills*, RAND, RGSD-147, 1999.

flights may be needed to regain proficiency lost rather than to gain proficiency in new skills. Consequently, pilots who take appreciably longer to reach 500 hours may not have developed as fully as pilots who reach 500 hours in the normal amount of time.

Unit experience problems can be exacerbated by frequent contingency deployments and the split operations that result when a portion of a unit is deployed while the remainder attempts to continue flying operations at its home base. Current difficulties that are plaguing operational units are documented in recent articles in *The Combat Edge*, ACC's mishap prevention magazine.¹⁷

¹⁷See, for example, the companion articles "A Wing Trying to Fly" and "A Command Trying to Fly" featured in the September 1999 issue.

CONTROLLING EXPERIENCE LEVELS

OPTIONS ARE LIMITED

Unfortunately, there are only a few ways to control the experience levels in operational units. One is to fly the additional hours the units need to eliminate the aging rate deficit for new pilots. Theoretically, a unit could increase its average above its programmed hours by the amount of the aging rate deficit and ensure that its new pilots aged at the programmed rate. If this were feasible for all fighter units, then the aggregate experience level could be maintained at the 40 to 45 percent levels shown in the upper curve in Figure 2.6. But as we have discussed, this would require additional hours to be programmed into the Air Force budget, a difficult and time-consuming process. Moreover, operational fighter units could not fly their programmed hours in FY1999, so it would be problematic for them to fly additional hours even if they were funded.

Absorb Fewer Pilots

If units cannot fly more in the near term, the only remaining way to maintain experience levels is to absorb fewer pilots into the units. The simplest means of implementing this option would be to train fewer pilots. Although this alternative is contrary to countering a shortage of pilots, it improves experience at the squadron level, as shown in Figure 3.1.

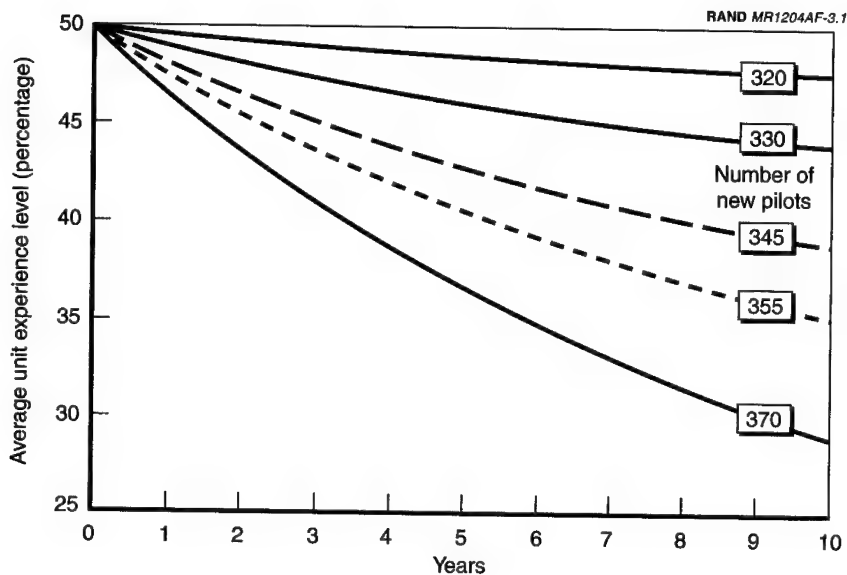


Figure 3.1—Experience Levels Improve as Fewer Fighter Pilots Are Absorbed in Operational Units

Reduced Pilot Production Is Not a Viable Long-Term Solution

Recall that 370 was the number of new pilots required each year to sustain existing fighter requirements, if current loss rates of active duty pilots continue. Reducing the production of new pilots can provide long-term help only if accompanied by simultaneous reductions in pilot requirements or improved pilot retention. It is useful to recall here that pilot requirements have been reduced by almost 40 percent (almost 60 percent in nonflying staff billets) in less than a decade, so further reductions may be difficult. The Air Force is currently examining alternative manning options, however, to identify an equivalent means to fill a small number of pilot requirements. Because pilots possess unique operational knowledge and qualifications, these options focus on using military retirees in positions they occupied on active duty. Thus they apply to a few nonflying staff billets only.

As we discussed earlier, airline demand, a primary factor that cuts into retention, is unlikely to decline. As a result, a passive approach probably will not be successful, and aggressive retention initiatives may be required. The Air Force is considering more liberal bonus options for active duty pilots and the possibility of implementing bonus options for full-time Total Force pilots (i.e., full-time Guard and Reserve pilots). It is uncertain however, that this would generate a significantly lower steady-state production requirement.

We thus seek alternatives that would yield the same advantages without reducing fighter pilot production levels. Because new pilots must be absorbed into operational units, and because units in the Guard and Reserve have much higher experience levels than active units do, we examined several Total Force alternatives.¹

TOTAL FORCE ALTERNATIVES

The first option we examined was a follow-on to PROJECT SEASON, a program implemented in the early 1980s in response to the last serious peacetime pilot shortage. Other alternatives placed experienced Guard and Reserve associate instructor pilots (Associate IPs) in active duty units. These programs need to be evaluated in the context of increasing manning problems for Guard and Reserve units.

Follow-on to PROJECT SEASON

The Air Force once placed active duty pilots in Guard and Reserve units for an initial operational tour to retain manageable experience levels. Several implementation problems prevented the program from generating acceptance among current leaders in either the active or reserve forces.² We will quantify the effect of this policy before we examine its implementation issues.

¹Because the primary source for pilots in Guard and Reserve fighter units is experienced pilots who separate from active duty, these units have average experience levels above 95 percent.

²PROJECT SEASON still arouses emotions and resentment arising from reports that the retention, safety, and discipline of pilots suffered relative to their contemporaries who flew only in active units. These concerns must be considered in any evaluation of

The quantitative effect of absorbing new fighter pilots in Guard and Reserve units is shown in Figure 3.2.

The upper line shows what happens when 40 (of the 370 new fighter pilots trained per year) active pilots become experienced in nonactive fighter units. The other lines show the result if fewer active pilots go to Guard or Reserve units. The range of up to 40 active pilots per year (developed by the Rated Management Task Force) has the concurrence of the Guard and Reserve leadership.³

The similarity of the top line to the line reflecting a zero aging rate deficit in Figures 2.5 and 2.6 is intriguing. Figure 3.3 confirms that reducing the input of new fighter pilots to active-duty operational

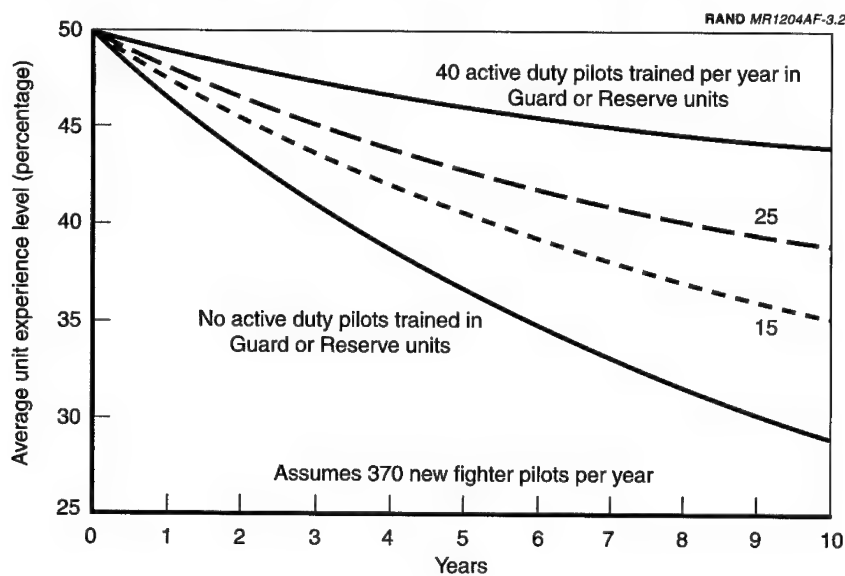


Figure 3.2—If Active Pilots Can “Age” in Guard or Reserve Units, Experience Levels Will Be Higher in Active Fighter Units

Total Force exchange options, and the implementation of such an option must deal with them directly to ensure that such problems are prevented.

³Provided the conditions that we discuss below are met.

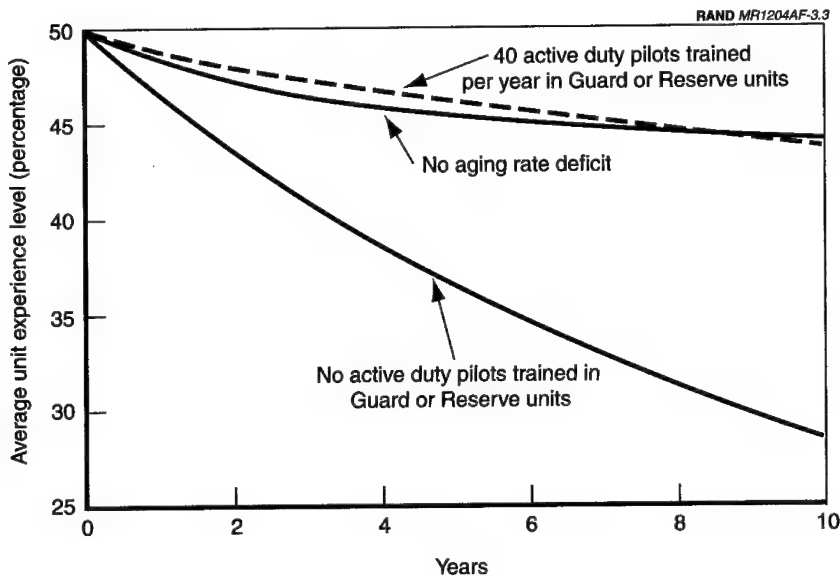


Figure 3.3—Training 40 Pilots Per Year in Guard or Reserve Units Essentially Eliminates the Effect of the Aging Rate Deficit

units would produce an experience dynamic very similar to the one generated by a utilization rate (UTE) increase large enough to eliminate the aging rate deficit.

A primary difficulty with the previous PROJECT SEASON initiative was the result of the short (five- or six-year) active duty service commitment (ADSC) that the participating pilots incurred. When coupled with a liberal PALACE CHASE policy⁴ that was also in effect at the time, this made most of the pilots eligible to affiliate with the Guard or Reserve when they finished their initial operational flying tour. The young pilots who favorably impressed their Guard (or Reserve) unit leaders were heavily recruited to leave active duty and remain in the same unit. Conversely, the participating pilots who did

⁴PALACE CHASE is a policy that waives a portion of an active duty service commitment for certain individuals willing to commit to serving for a comparable period in a Guard or Reserve unit in a job utilizing the training that generated the original service commitment.

not perform well during this initial operational tour were certain to return to an active unit because their Guard or Reserve unit was unwilling to keep them (even if they wanted to affiliate and were eligible to do so). This situation could have generated a negative performance bias in the group who stayed on active duty—a disproportionate share of them failed to distinguish themselves during their initial operational tour, whereas pilots who performed well were likely to respond to encouragement and separate from active duty.⁵ The 10-year ADSC that new pilots now incur should resolve this problem because pilots who join a Guard or Reserve unit will remain ineligible to affiliate with that unit for some four to six years after they depart. Heavy recruiting by their unit leaders will be precluded because leadership positions will normally turn over completely during the intervening period.

Safety and discipline problems were mentioned in several versions of the *Rated Management Document*, but we found no specific documentation of these problems. It is true that the Guard and Reserve units were tasked to accept the additional pilots without additional resources (such as flying hours or manhours) to ensure that essential supervision and adequate training were available. Also, the participating active pilots were required only to meet Guard and Reserve annual sortie and training requirements instead of the active requirements.⁶ This meant that participants flew significantly fewer sorties during their initial operational tours than did contemporaries who were flying in active units. Thus, the PROJECT SEASON participants did not age as effectively as active contemporaries, and their pilot skills may have developed more slowly.

We strongly feel that any implementation plan for this Total Force exchange program must provide these essential training and supervisory resources. If the Air Force is to implement a follow-on pro-

⁵This issue has strong anecdotal support. One ANG commander told us that his unit hired five or six PROJECT SEASON pilots who had participated in that unit. Another ANG commander overheard and commented, "Yes, and the sixth was a pilot they didn't want."

⁶Under the Graduated Combat Capability (GCC) training standards that were in effect at the time, the Guard and Reserve requirements represented an even smaller proportion of the active sortie requirements than is the case under the current Ready Aircrew Program (RAP).

gram to PROJECT SEASON, it should ensure that the job is done properly. There is certainly a requirement for additional sorties in the participating units. Indeed, such exchanges would effectively transfer the UTE requirements for absorbing these pilots *out of* active units and *into* Guard and Reserve units. Although the supply and engine problems that constrain active unit UTE rates adversely affect Guard and Reserve sortie generation capabilities as well, we believe that the relative experience levels make such a program a more efficient endeavor in highly experienced Guard or Reserve units than in less-experienced active units. Also, moving the UTE increase to the Guard and Reserve will reduce its marginal cost. Even though the additional sorties required by each of the inexperienced pilots will need to be added, there is no requirement to add the large number of *redundant* supervisory flight lead and IP sorties that Chapter Two confirmed are required for new pilots in an active unit with low experience. The required increase may in fact be achieved in a Guard or Reserve unit, whereas the current limits on active aircraft utilization make it unlikely that this would be the case in active units. This program also imposes additional supervisory responsibilities on the absorbing units—requirements not addressed in current Guard and Reserve manning and grade authorizations. Additional authorizations will be required (at least on a temporary basis) to ensure essential supervision.

Associate Programs

Associate units, in which reserve and active crews both fly aircraft that are assigned to active units, have operated effectively in the transport and tanker communities for several decades. The Air Force was implementing two distinct associate programs while we were conducting our analysis: the undergraduate flying training (UFT) Associate IP program and the fighter reserve associate test (FRAT) program. The FRAT program is a small two-squadron feasibility test, whereas the UFT Associate IP program is more expansive and designed to replace the requirement for over 200 *experienced* (i.e.,

weapon system identified) instructor pilots in active UFT units flying generic training aircraft.⁷

Although the FRAT program was not designed to address the experience issues that are examined here, it does place experienced reserve Associate pilots in operational units. The program replaces two active RPI-1 pilots in the affected unit with four part-time RPI-1 reserve pilots, one full-time RPI-1 reserve pilot, and one full-time RPI-6 reserve commander, thus potentially freeing two experienced pilots to be used elsewhere. On the negative side, it could reduce the total number of absorbing billets, and it could carry an implied aircraft utilization increase. Like most Total Force options, it requires testing and objective evaluation to understand all of its advantages and disadvantages.⁸

Although our assumption that enough experienced fighter pilots are available to fill the cockpits means that the UFT Associate IP program would not directly affect experience levels in the operational units, the program certainly makes it more likely that the assumption is valid. This advantage led us to consider the potential for introducing Associate IP programs in the formal training units (FTUs) as well. Such an initiative could replace the requirement for up to 150 experienced fighter pilots with Guard or Reserve pilots, thereby freeing the active pilots to remain in operational units, be reassigned to staff billets, or be used in another capacity. Again, the pros and cons of this initiative need to be fully investigated. In today's fast-paced deployment environment, for example, these training billets (which allow incumbents to fly fighters with no overseas contingency tasking) have come to be regarded as very desirable assignments. Thus, moving them into the Guard or Reserve may limit the opportunity for

⁷The program objective is to replace 225 active-duty experienced instructor pilot billets with 117 full-time Active Guard/Reserve (AGR) and 425 part-time reserve Associate IPs. At least half of the associate instructors will be fighter pilots. The aircraft that are flown are the T-37 and T-38 for fighter pilots and the T-37 and T-1 for mobility pilots. Data are from Air Force Reserve Components (AFRC) and Air Education and Training Command (AETC) sources.

⁸The original purpose of this program was to test the feasibility of the associate concept for fighters. Although the number of pilots involved is small, an objective is to examine conceptual issues that may require resolution were a more widespread implementation to be envisioned.

active pilots to vie for these beneficial nonoperational flying assignments.

Any objective evaluation of these Total Force alternatives, however, will need to incorporate a full understanding of the unique personnel issues that will face Guard and Reserve flying units in the very near future.

Guard and Reserve Manning Issues

Guard and Reserve fighter units recruit the vast majority of their pilots from active-duty losses, which usually occur at the end of the initial active duty service commitment (end-ADSC).⁹ The heavy active duty losses that generated the current pilot shortage form a sizable pool of qualified applicants from which the Guard and Reserve units have been able to select new hires. For several years, hiring in these units has been demand-constrained in the sense that there are fewer part-time billets available in these units than there are qualified pilots separating from active duty. This hiring advantage will vanish in FY2002 when 400 pilot cohorts start to reach end-ADSC. One can see this easily in Figure 1.1 where the inventory line goes flat. These units will then have an extremely difficult time finding qualified personnel leaving active duty at end-ADSC. As the ADSC transitions from eight to ten years, this effect will continue through FY2009, which means these units could suffer during the hiring drought.

Most of these units rely on full-time pilots to provide key training and scheduling support functions. Full-timers typically represent about a third of an operational unit's total (RPI-1 and RPI-6) pilot authorizations. Full-time Guard manning is provided either by Active Guard/Reserve (AGR) personnel or by civilian technicians. Reserve units have traditionally used Air Reserve Technicians (ARTs) for their

⁹Most Guard units also train limited numbers of pilots (typically no more than one per unit per year) from scratch. The individual is sent through a commissioning program as well as UFT and FTU, which translates into a two-year full-time commitment prior to returning to the unit. This must be followed by several years of essentially full-time flying in the unit to age adequately and become experienced in the aircraft. Reserve units, on the other hand, rely almost entirely on pilots who gained their training and experience on active duty.

full-time billets, but the new associate programs are also admitting AGRs. Few full-timers are assigned to the squadron; most are RPI-6 IPs who are assigned to the wing or group in O-4 or O-5 billets. It is expected that the need for full-timers will increase as operational units receive their Air Expeditionary Force (AEF) tasking to support overseas contingency operations.

The same demand from the major airlines that is influencing departure decisions for active duty pilots, however, is making it difficult for Guard and Reserve units to hire full-time replacements when incumbents in those billets retire or depart. The large number of pilots departing active duty in their 15th year or beyond has added hiring options into AGR billets that carry an O-4 or O-5 grade authorization. Rigid grade structures and other constraints on hiring flexibility in many units, however, will prevent units from taking full advantage of this relatively new pool of qualified pilots.¹⁰

These problems translate into a potential for synergies among fighter units in the Total Force over the next few years, and there is already increasing evidence of a renewed spirit of cooperation. Although we feel that current prospects for sufficient pilots for both active and reserve component units are sufficiently bleak to warrant a careful examination of all of these options, we also feel that implementation of any options must be executed carefully and continually evaluated as they are introduced. These initiatives deal with complex interrelationships, and there is a high potential for unwanted consequences to occur. For example, the FTU Associate IP program could be an effective means to take advantage of the losses of active pilots as they complete FTU IP assignments.¹¹ A more pessimistic view, however, holds that pilots are separating at this point because of an unwillingness to embrace active duty assignment alternatives that require a choice between nonflying options and compelling quality-of-life

¹⁰We also note that rigid grade distributions and Reserve Officers Promotion and Management Act (ROPMA) rules will make it difficult to hire anyone from active duty when the 10-year ADSC takes effect. Any pilot eligible to affiliate after separating from active duty must be considered for ROPMA promotion to O-4 within the first year after separating.

¹¹Air Force Personnel Center (AFPC) data indicate that over 90 percent of eligible pilots separated following an IP tour at Luke Air Force Base or Tyndall Air Force Base in FY1998.

concerns associated with a return to operational flying. The option to remain as Associate IPs would be perceived as extremely desirable in any case, because it provides the opportunity to fly fighters in a stable environment and offers other advantages.¹² Even more pilots might in fact resign to compete for this desirable option, so that an initiative designed to cope with high active-duty loss rates might backfire.

We recognize that the current situation in which more qualified pilots are separating than are being hired by Guard and Reserve units is a temporary circumstance that will quickly fade. Temporarily increasing the hiring flexibility (as well as providing grade and man-hour relief) for Guard and Reserve units could provide a major boost toward encouraging more of these pilots to affiliate and keep their knowledge and experience in the Total Force. This flexibility could help participating Guard and Reserve units provide essential supervision to inexperienced active pilots who have been assigned to units as part of the follow-on to PROJECT SEASON. Such authority could also provide a hedge for the hiring problems that are anticipated after FY2002. The brief window of opportunity, however, means that most of these initiatives need to be evaluated and implemented quickly if they are to take advantage of the special circumstance. Delays could make them infeasible owing to manning problems in the Guard and Reserve units. The underlying issue with these Total Force initiatives is that the issues are complex but time is critical.

The initiatives need to be evaluated in the context of whether Guard and Reserve units can recruit qualified candidates and remain fully manned (especially in their full-time authorizations) throughout the period from FY2002 through FY2009 when their hiring problem will be the most critical. If the Air Force is successful in its effort to improve active retention, Guard and Reserve manning issues will become even more difficult to resolve. When we add the problems as-

¹²The FTU bases (especially Phoenix and Tucson) generally are regarded as pleasant locations and easy commuting hubs for low-seniority airline pilots. Luke Air Force Base is the F-16 FTU base and is near Phoenix. Tyndall Air Force Base is the F-15C FTU and is near Panama City, Florida. The A-10 FTU is at Davis-Monthan Air Force Base near Tucson, and the F-15E FTU is at Seymour Johnson Air Force Base near Goldsboro, North Carolina.

sociated with the future of these fighter units as a part of the AEF, we can more fully appreciate the complexities that complicate the policy alternatives. All of these complex interrelationships require thorough and efficient examination to determine the value of any Total Force initiatives in countering the pilot shortfall and the associated experience problems.

Chapter Four

CONCLUSIONS

Chapter One of this report described the Air Force's current pilot shortage, put its size in perspective, and developed some of its primary characteristics. The retention issues that generated the shortage, especially the changing nature of major airline demand and its increase relative to the supply of military pilots, were discussed in more detail. Chapter Two developed the underlying aging rate issues that arise in inexperienced units and prevent new pilots from developing at acceptable rates. When experience levels decrease in operational units that cannot fly more because of constraints on aircraft utilization, the experience levels can freefall out of control. This "slippery slope" could severely compromise the ability of units to accomplish their primary missions or meet AEF demands. Chapter Three discussed the limited options available to control these experience problems. Although the only assured solution is to reduce the number of pilots absorbed into operational units, this cannot be accomplished by implementing a long-term reduction in pilot production without either reducing requirements or improving retention, prospects that may be questionable at best. We also examined the potential for Total Force alternatives to alleviate the experience problems generated by the pilot shortage. Although these alternatives show promise, they must be implemented carefully and evaluated thoroughly to deal with cultural issues and prevent unintended consequences. This care and diligence must be exercised quickly while there is still a relatively large pool of pilots leaving active duty. The potential affiliation pool for Guard and Reserve units becomes seriously constrained after FY2002.

Our results went to participants of the Four-Star Rated Summit convened in April 1999. The following actions were among the policy decisions resulting from that summit:

- Set 55 to 60 percent as the low-end experience level goal for fighter units
- Reduced fighter FTU production to 330 pilots per year, with 30 of these to be absorbed in Guard and Reserve units
- Supported the UFT Associate IP program
- Tasked appropriate agencies to examine the feasibility of using Associate IPs in FTUs.

These are essential steps to prevent the experience problem from becoming unmanageable. It is important to recognize, however, that retention must improve significantly and alternative manning options must be effective if production levels are to be sustained at 330 fighter pilots per year. We are encouraged that the Air Force will pursue the Total Force initiatives despite the implementation issues they present. We also recommend that additional retention initiatives (similar to PHOENIX AVIATOR) that defer, rather than discourage, airline careers for military pilots be examined more aggressively. Such programs could have a propitious effect on loss rates.

Figure 4.1 projects experience levels under the summit policies, if fighter units fly at their programmed rates.

These are encouraging results: even if a notional unit reaches its minimum of 55 percent, experience levels remain within bounds when programmed hours are flown.¹ The aging rate deficit does not grow too large. But if units cannot fly at their programmed rates, there remains considerable cause for concern. Figure 4.2 depicts experience levels for a notional unit that averages two hours per crew per month (HCM) below its programmed average.

¹It was necessary to change the vertical scale from the previous figures in which a 50 percent experience level provided the initial conditions. The subsequent experience drop of under 2 percent from the 55 percent minimum is within the error limits of our model.

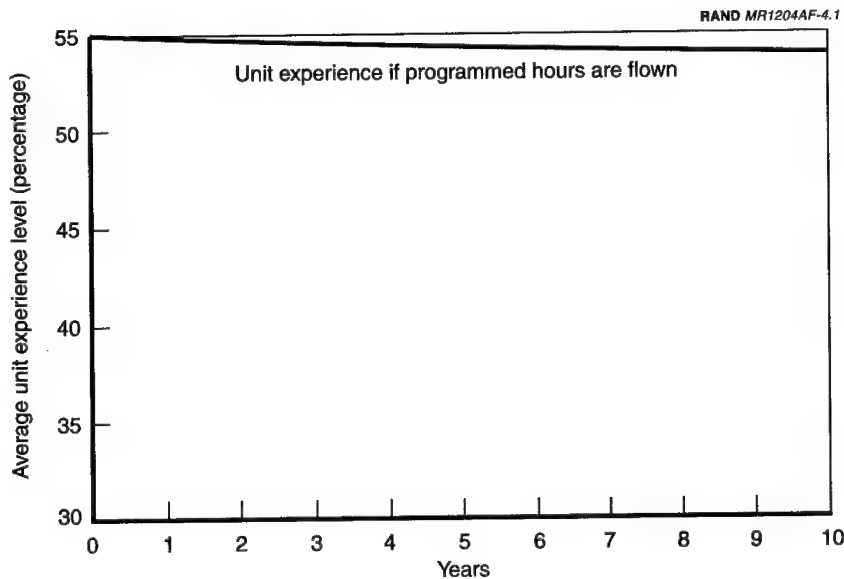


Figure 4.1—If Units Fly at the Programmed Rate, They Can Maintain Experience at Acceptable Levels

Figure 4.2 confirms that aging rate deficits return if units cannot fly their programmed flying hours, and experience declines will result. This result generates another caveat in examining whether the Rated Summit's policy decisions will resolve critical experience problems. These decisions can be effective only if aircraft utilization (UTE) rates can improve enough to allow operational units to fly their programmed hours. This caveat adds to our previous observations that retention must improve and alternative manning options must be sought if production levels are to be kept low indefinitely. If such initiatives are not sufficiently effective, even greater UTE increases will be needed to increase production and avoid the aging rate problems that cause critical experience shortfalls. It is important to continue to explore Total Force initiatives with the intent of identifying and developing the available synergies.

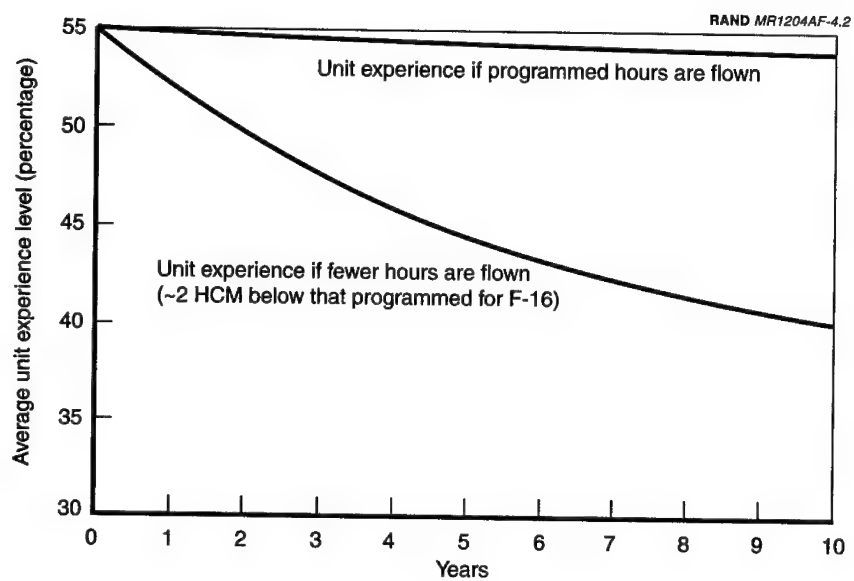


Figure 4.2—If Units Fly Below the Programmed Rate, Aging Rate Problems Restore the “Slippery Slope”

A BRIEF OVERVIEW OF RAND'S OPERATIONAL UNIT TRAINING MODEL

RAND's operational unit training model is a work in progress. It was developed initially to help the Air Force estimate (and justify) annual flying-hour needs. We used the model to analyze experience issues in operational units at the request of the Vice Chief of Staff of the Air Force.

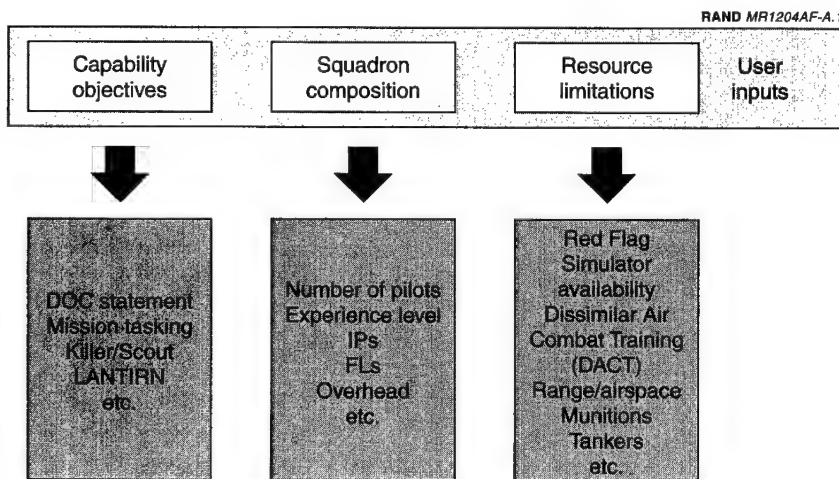
The model is *skill-based* in the sense that it calculates the training needed to maintain and develop essential skills rather than tallying the accomplishment of specific training events. In measuring the training required under different experience conditions, it goes far beyond merely summing individual pilots' needs to arrive at the unit requirements.

Turnover in a unit generates continual upgrade needs: to advance new pilots to initial mission ready status, to advance wingmen to flight leads, flight leads to instructor pilots, and so forth. All upgrade sorties and most normal training sorties must be supervised by a flight lead (FL) or instructor, a requirement that drives the unit's need for sorties beyond the sum of the individual needs. Our model calculates that, even at relatively high experience levels (above 65 percent), flight leads and IPs must fly more than enough to meet their own training needs. They must also fly to service the training needs of less-experienced, less-qualified squadron members. The RAP requirement that inexperienced wingmen fly more sorties than experienced flight leads is rarely realized in real life. As experience drops and fewer pilots are qualified to become flight leads and instructors, those who do qualify tend to fly more often. This outcome

reveals the importance of accurately quantifying training needs for an entire unit.

The model's inputs are straightforward, beginning with the unit's mission tasking reflected in the squadron's Designated Operational Capability (DOC) statement, as well as any special tasking for which the unit is responsible. The schematic in Figure A.1 illustrates missions for a notional F-16 LANTIRN unit.

Next, the model accepts the composition of the squadron's aircrews: the numbers of pilots who are experienced or inexperienced, qualified as flight leads, IPs, CMR, or basic mission capable (BMC), classified as RPI-1 or RPI-6, and so forth. The third category of inputs describes resource limitations and imposes reasonable limits on such things as simulator availability, RED FLAG deployments, and the availability of DACT.¹



NOTE: Flying hours/UTE not constrained in current version.

Figure A.1—The Model Starts with Fundamental User Inputs

¹We plan to incorporate certain resource limitations, such as ranges and airspace, training munitions, tankers, and the like, in the model eventually, but they have not yet been integrated.

The model examines the skills required to accomplish all of the unit taskings and matches the skills against training activities that develop or practice particular skills.²

Figure A.2 shows key relationships among elements within the model. The model's key variables represent how many times each type of pilot flies each version of each training activity during a specified training period. The underlying mission-related skills provide the fundamental linkages between operational capabilities and training activities. While imposing realistic supervisory and training constraints, the model selects a combination of training activities that ensure that every pilot can develop and maintain the skills needed for his prescribed mission capabilities.³

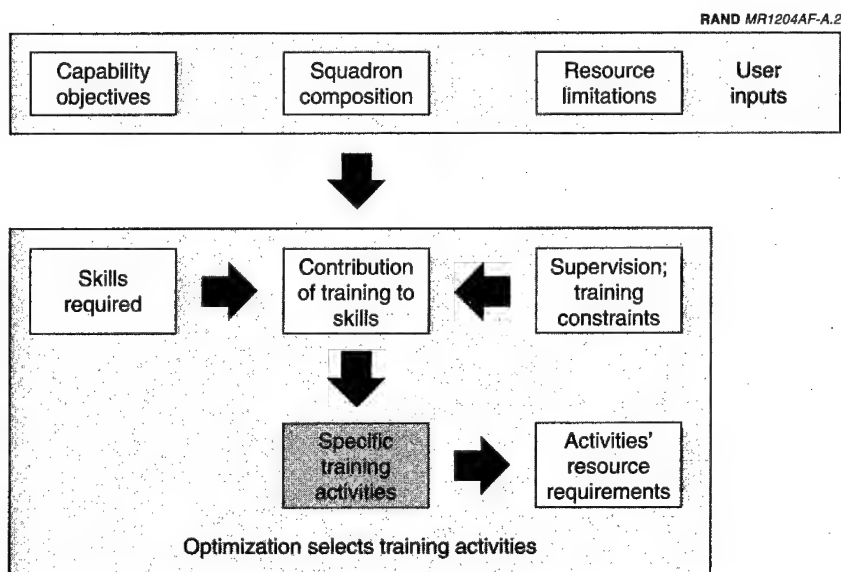


Figure A.2—The Model Next Matches Required Skills to Available Training Activities

²There are 150 skills or more identified for every MDS and every tasking.

³The optimization process minimizes the number of sorties required by the squadron to ensure that every pilot meets specific requirements for every required skill. As in the real world, the sortie mix that accomplishes this is never unique, and the skill requirements can be satisfied in a variety of ways.

Figure A.3 summarizes the model's outputs. Only the first block of outputs has been coded and is available at this juncture: the combinations and numbers of sorties recommended for each category of pilot. We intend to incorporate the outputs shown in the two bottom blocks.

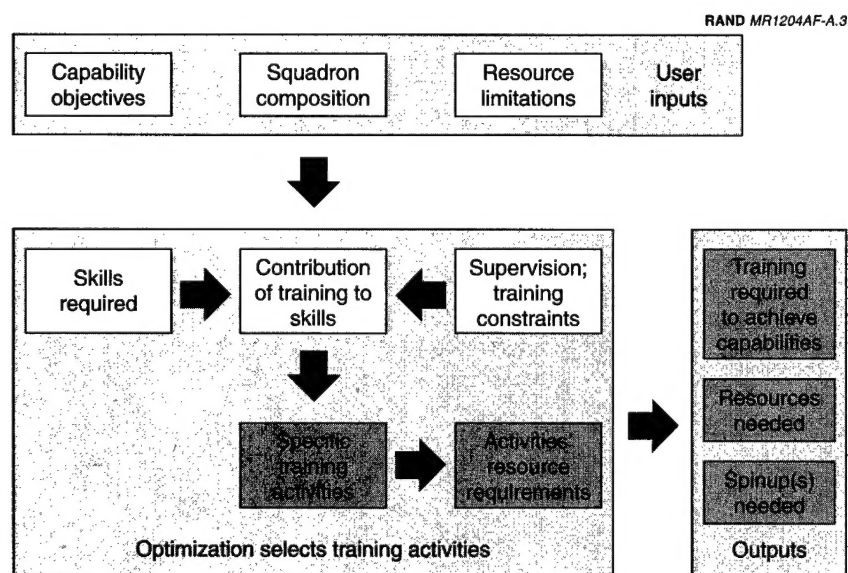


Figure A.3—Finally, the Model Identifies Essential Training and Tallies the Resources Required

Appendix B

DERIVATION OF FORMULAS USED IN
LOW-EXPERIENCE EXAMPLES

Let $s(x)$ denote the average sorties per experienced pilot (per month) and $s(n)$ the average per inexperienced pilot, where x and n denote the number of pilots of each type, respectively. For the 33 percent case with two wingmen per flight lead, we have¹

$$n = 2x \quad \text{and} \quad s(x) = 2s(n),$$

so the squadron average is

$$\text{avg} = [xs(x) + ns(n)] / (x + n) = [2xs(n) + 2xs(n)] / 3x = (4/3)s(n).$$

Consequently,

$$s(n) = (3/4) \text{ avg} \quad \text{and} \quad s(x) = 2s(n) = (1.5) \text{ avg}.$$

If X denotes the flying hours needed to become experienced in K months, averaging h hours per month, then $X = Kh$. But if an inexperienced pilot averages only $(3/4)h$ hours per month, it takes L months to become experienced, where $X = L(3/4)h$. Equating Kh and $(3/4)Lh$ implies that $L = (4/3)K$. That is, it takes an inexperienced pilot 33 percent longer to become experienced when averaging only $3/4$ of the squadron's average flying hours per pilot per month.

¹The cases are similar that use 25 percent and hours instead of sorties.

BIBLIOGRAPHY

Aviation Information Resources (AIR, Inc.), *Airline Pilot Career Development System*, Vol. 1-10, Atlanta, GA, 1997-1998.

Aviation Information Resources (AIR, Inc.), memorandum on Major Airline Information and Data, Atlanta, GA, 1998.

Conetta, Carl, and Charles Knight, *The Readiness Crisis of the U.S. Air Force: A Review and Diagnosis*, Commonwealth Institute, Briefing Report 10, 22 April 1999.

Department of the Air Force, *Aircrew Management Document*, September 1997.

Department of the Air Force, *Rated Management Document*, September 1985-September 1996.

Department of the Air Force, Rated Management Task Force, *Rated Management Primer*, January 1999.

FAA, *Aviation Forecasts FY 1997-2008*, FAA-APO-97, Washington, D.C., March 1997.

FAA, *Aviation Forecasts FY 1998-2009*, FAA-APO-98, Washington, D.C., March 1998.

FAA, *Aerospace Forecasts FY 1999-2010*, FAA-APO-99-1, Washington, D.C., March 1999.

FAA, *Aerospace Forecasts FY 2015, 2020 and 2025*, FAA-APO-99-5, Washington, D.C., June 1999.

GAO Report, *DOD Aviator Positions: Training Requirements and Incentive Pay Could Be Reduced*, GAO/NSIAD-97-60, Washington, D.C., February 1997.

GAO Report, *Military Personnel: Actions Needed to Better Define Pilot Requirements and Promote Retention*, GAO/NSIAD-99-211, Washington, D.C., August 1999.

GAO Testimony, *Military Pilots: Observations on Current Issues*, GAO/T-NSIAD-99-102, Washington, D.C., March 1999.

Headquarters (HQ) USAF/DP (Briefing), *CORONA South, FY00 Pilot Picture*, Washington, D.C., February 1999.

Headquarters (HQ) USAF/DP (White Paper), *The Pilot Shortage: USAF's Integrated Plan*, Washington, D.C., September 1999.

Headquarters (HQ) USAF/XOOT, *Bullet Background Paper, PROJECT SEASON*, Washington, D.C., November 1997.

Levy, Claire Mitchell, *The Civilian Airline Industry's Role in Military Pilot Retention: Beggarman or Thief?* RAND, DB-118-OSD, 1995.

Mayeux, Sid (Maj, USAF), "A Command Trying to Fly," *The Combat Edge*, Air Combat Command's Mishap Prevention Magazine, September 1999, pp. 8-9.

Stephens, Dean (Capt, USAF), "A Wing Trying to Fly," *The Combat Edge*, Air Combat Command's Mishap Prevention Magazine, September 1999, pp. 4-7.

Stillion, John, *Blunting the Talons: The Impact of Peace Operations Deployments on USAF Fighter Crew Combat Skills*, RAND, RGSD-147, 1999.

Thie, Harry J., William W. Taylor, Claire Mitchell Levy, Clifford M. Graf II, and Sheila Nataraj Kirby, *A Critical Assessment of Total Force Pilot Requirements, Management, and Training*, RAND, DB-121-OSD, 1994.

Thie, Harry J., William W. Taylor, Claire Mitchell Levy, Sheila Nataraj Kirby, and Clifford Graf II, *Total Force Pilot Requirements and Management: An Executive Summary*, RAND, MR-646-OSD, 1995.